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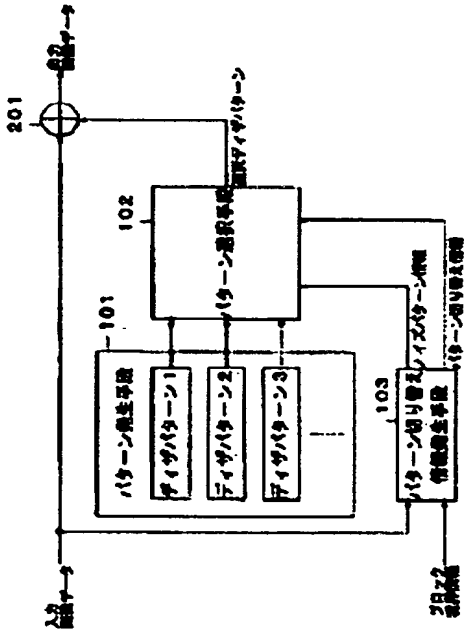
(54) DITHER PROCESSOR

(57)Abstract:

PROBLEM TO BE SOLVED: To provide a dither processor, provided with action for eliminating block noise that occurs in image data decoded using discrete cosine transform.

SOLUTION: The presence/absence of block noise and the pattern of the block noise are analyzed in a range where one dither pattern is attached to image data to be a processing object, a dither pattern to be reference and a plurality of dither patterns prepared, by adding or subtracting a particular offset to/from a portion of the pattern or each of the entire pixels are prepared in advance, dither patterns, having action that reduces block noise are selectively switched among the plurality of dither patterns; and thereby the block noise can be reduced at the same time as with dither processing.



* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention]This invention relates to a dither processing unit with the function which reduces the block noise produced when elongating the video signal compressed by the discrete cosine transform.
[0002]
[Description of the Prior Art]In digital display units, such as a liquid crystal panel, since the gradation which can be displayed is restricted, the false intermediate floor tone display technique like dithering is used well. For the more nearly high-definition false intermediate floor tone display, the system of a large number, such as dithering according to the feature of the image, is examined.
[0003]On the other hand, when dealing with a video signal in digital one, since the amount of information becomes huge, compression technology, such as a discrete cosine transform, is used widely. When elongating the compressed data using a discrete cosine transform, the difference in the DC levels for every macroblock may serve as a block noise, and visual sense of incongruity may be given. Many methods of removing such [conventionally] a block noise are also examined.
[0004]
[Problem to be solved by the invention]The technique of the conventional dithering, ****** [distinguishing the field of a character with few intermediate

floor tones, or a figure, and the field of a photograph with many intermediate floor tones, and performing dithering] -- accommodative -- changing (for example, JP,62-299176,A) -- the edge of a picture. [detect and] Techniques, such as changing the coefficient of control accommodative (for example, JP,63-35071,A), are proposed.

[0005]However, there is no effect that these methods make a block noise reduce. If it is a case where dithering is furthermore performed to Still Picture Sub-Division, it has the problem that a noise may become conspicuous, by adding a dither pattern to the pixel from which DC levels are changing by a block noise rather.

[0006]If it judges that the block noise has, on the other hand, generated the method of removing the conventional block noise, in the block border, techniques, such as making a noise reduce with a filter etc. (JP,10-229546,A), are proposed.

[0007]However, these methods constitute the low pass filter which makes a noise reduce from a digital circuit, and have the problem that circuit structure will become large.

[0008]This invention solves such problem.

The purpose is to provide a dither processing unit and a method with the function which reduces the block noise produced when elongating the video signal compressed by the discrete cosine transform.

[0009]

[Means for solving problem]The pattern generating means which generates the dither pattern from which invention of Claim 1 of an application concerned serves as a standard, and two or more dither patterns created by the thing which constitute said dither pattern, and for which specific offset is added or subtracted to all the pixels of each in part, Pattern change information is outputted on the boundary of the dither matrix arranged so that the boundary of a dither pattern added to the inputted image data decoded by the discrete cosine transform used as the boundary of the macroblock of the discrete cosine transform which block boundary information shows, and a processing object may be in agreement, And the pattern change information generation means which outputs the pattern of a block noise as noise-patterns

information when having generated with whether the block noise has occurred in the dither pattern containing said inputted image data used as a processing object, The pattern selecting means which chooses the optimal pattern from said two or more dither patterns generated in said pattern generating means according to said noise-patterns information in the image display position which said pattern change information shows, and is outputted as a selection dither pattern, It is a thing about having an adding machine which is added with said selection dither pattern and said inputted image data, and is outputted as output image data.

[0010]Invention of Claim 2 of an application concerned is provided with the following.

The pattern generating means which generates a dither pattern so that the boundary of a dither pattern added to the inputted image data decoded by the discrete cosine transform used as the boundary of the macroblock of the discrete cosine transform which block boundary information shows, and a processing object may be in agreement.

The bias information generation means which outputs the bias which amends a block noise when the block noise has occurred in the dither matrix which contains the inputted image data used as a processing object from said inputted image data and said block boundary information as bias information.

The 1st adding machine that adds said bias information and said dither pattern, and is outputted as a dither pattern with bias, and the 2nd adding machine that adds said dither pattern with bias, and said inputted image data, and is outputted as output image data.

[0011]In the dither processing unit of Claim 2, invention of Claim 3 of an application concerned performs low pass filter processing to the bias information outputted from said bias information generation means, and adds the low pass filter outputted as filtering finishing bias information.

[0012]Invention of Claim 4 of an application concerned is provided with the following.

The pattern generating means which generates a dither pattern so that the boundary of a dither pattern added to the inputted image data decoded by the discrete cosine transform used as the boundary of the macroblock of the

discrete cosine transform which block boundary information shows, and a processing object may be in agreement.
The bias which amends a block noise when the block noise has occurred in the dither matrix containing the inputted image data decoded by the discrete cosine transform and the inputted image data which serves as a processing object based on block boundary information is outputted as bias information, When luminance difference with the adjacent pixel which adjoins the value adding the luminance value of a noticed picture element and corresponding bias information and a noticed picture element is larger than luminance difference with the adjacent pixel which adjoins the noticed picture element which the block noise has generated in inputted image data, and a noticed picture element, The bias information and adjacent pixel information generation means which output the adjacent pixel information which shows that the low pass filter processing to bias information corresponding near the noticed picture element is enabled.
Low pass filter processing is carried out to the bias information to which adjacent pixel information is outputted from said bias information generation means only to the part of enabling, The low pass filter with condition determination outputted to the part which is not enabling as filtering finishing bias information without carrying out low pass filter processing to bias information, The 1st adding machine that adds said bias information and said dither pattern, and is outputted as a dither pattern with bias, and the 2nd adding machine that adds said dither pattern with bias, and said inputted image data, and is outputted as output image data.

[0013]Invention of Claim 5 of an application concerned is provided with the following.
The pattern generating means which generates several different dither patterns.
Data of each pixel of the result of having added said several different dither patterns to the inputted image data of the picture element range which adds one pattern used as a processing object, respectively.
The inputted image data of the picture element range which adds one pattern used as said processing object is compared based on an internal algorithm,

The adding machine which is added with the minimum error pattern selecting means which chooses one dither pattern from said two or more dither patterns, and is outputted as a selection dither pattern, and said selection dither pattern and said inputted image data, and is outputted as output image data.

[0014]Two or more dither patterns with the operation which reduces the block noise produced by these composition when decoding an image by a discrete cosine transform are created beforehand, It becomes possible to add the offset which changes a dither pattern selectively by an internal algorithm, or reduces a block noise at the time of dithering, and a block noise can be reduced simultaneously with dithering.

[0015]

[Mode for carrying out the invention]The graphic processing equipment in the form of each working example of this invention is explained referring to Drawings. The embodiment of the invention assumes using for false intermediate floor tone expression which used dithering. All the embodiments shown below are explanation about the portion which adds a dither pattern.

[0016](Embodiment 1) Drawing 1 is a block diagram showing the composition of the dither processing unit of the embodiment of the invention 1. This graphic processing equipment has the pattern generating means 101, the pattern selecting means 102, the pattern change information generation means 103, and the adding machine 201.

[0017]The inputted image data of this equipment is the signal which elongated the compressed image which used discrete cosine transforms, such as MPEG, and output image data is sent out to an external display device etc. The pattern generating means 101 generates two or more two or more dither patterns. The pattern change information generation means 103 creates noise-patterns information and pattern change information from inputted image data and block boundary information. The pattern selecting means 102 chooses one pattern from two or more patterns by which it was generated in the pattern generating means 101 based on noise-patterns information and pattern change information, and outputs it as a selection dither pattern. The adding machine 201 adds a selection dither pattern to inputted image data,

and outputs it as output image data.

[0018]Operation of the dither processing unit constituted as mentioned above is explained below. The pattern generating means 101 generates two or more two or more dither patterns. An internal pattern is set to five in this embodiment. However, this number in particular is not limited, and even if there are more patterns than this, there is no problem in particular at least.

[0019]The pattern by which it is generated in the pattern generating means 101 is shown in drawing 2. The pattern 1 is a basic pattern. The half-tone of 4x4 is used in this embodiment. It is not necessary to limit basic pattern to half-tone, and patterns generally used well, such as a screw and Mayer, can also be realized. The pattern 2 adds the offset 1 to the 2nd row of the pattern 1, adds the offset 2 to the 3rd row, and adds the offset 3 to the 4th row. The pattern 3 subtracts the offset 1 from the 2nd row of the pattern 1, subtracts the offset 2 from the 3rd row, and subtracts the offset 3 from the 4th row. The pattern 4 adds the offset 3 to the 1st row of the pattern 1, adds the offset 2 to the 2nd row, and adds the offset 1 to the 3rd row. The pattern 5 subtracts the offset 3 from the 1st row of the pattern 1, subtracts the offset 2 from the 2nd row, and subtracts the offset 1 from the 3rd row.

[0020]Next, operation of the pattern change information generation means 103 is explained. The pattern change information generation means 103 creates noise-patterns information and pattern change information from inputted image data and block boundary information. Block boundary information shows the boundary position of the macroblock of the inputted image data which elongated the compressed image which used discrete cosine transforms, such as MPEG. Reference is not made in particular about the acquisition means of block boundary information. If it is a case where the inputted image data which has the information the picture display system containing this embodiment shows image data viewing areas, such as data enabling, to be clearly, and elongated the compressed image is not processing scaling etc., It can be judged that there is a block border at intervals of the size of a macroblock from the head of a display.

[0021]If the picture display system containing this embodiment has a decoder etc. which elongate a compressed image inside, it is also possible to acquire block boundary information from this decoder. A block border may be

presumed from the feature of inputted image data. Even if it is which case, the macroblock (MB) and dither matrix (DM) in a display image are arranged so that it may become physical relationship as shown in drawing 3. In this embodiment, a dither matrix is the size of 4x4, and four dither matrices exist in the area of each macroblock, respectively. Pattern change information shows the boundary position of a macroblock, and the boundary position of the dither matrix in a macroblock. The pattern selecting means 102 is doubled with the boundary of a macroblock based on pattern change information, and it changes a dither pattern so that four dither matrices may exist in the area of each macroblock. Under the present circumstances, it mentions later which dither pattern is chosen. Let pixel area which is adapted in one dither pattern be a dither-matrix adaptation field to inputted image data. If the macroblock which contains a noticed picture element here is set to MB (s, t), the dither matrix containing a noticed picture element can express a noticed picture element like PA (8s+2, st+5), for example like DM (2s+1, 2t).

[0022]Next, the generation method of the noise-patterns information in the pattern change information generation means 103 is explained. This noise-patterns information shows whether that block noise exists, when a block border exists [whether when the image data to display is divided in the above-mentioned dither-matrix adaptation field, a block border exists in each dither-matrix adaptation field, and] again. This noise-patterns information contains right end amendment enabling information, left end amendment enabling information, a right end DC correction amount, and a left end DC correction amount.

[0023]The preparation method of the noise-patterns information shown by this embodiment is one example expressing the noise patterns in a dither-matrix adaptation field. It does not interfere, even if it expresses noise patterns by the method except being shown here.

[0024]When a block noise exists in the right end of the dither-matrix adaptation field containing a noticed picture element, it requires amendment and right end amendment enabling information is not [being truth and] so, it is considered as an imitation. A difference with the DC levels of the brightness component of the macroblock which adjoins the DC levels and right-hand side of a brightness component of an applicable macroblock is made into the DC-

levels difference between right end macroblocks, A level difference with the average DC levels of the brightness component of the pixel of the left end sequence of the dither-matrix adaptation field contiguous to the average DC levels and right-hand side of a right end sequence of a brightness component is made into the DC-levels difference between right end dithers. [of an applicable dither-matrix adaptation field] [of a pixel] The right end of the target dither-matrix adaptation field is a block border, In a macroblock including the target dither-matrix adaptation field, there is no edge component in inputted image data, When the DC-levels difference between right end macroblocks is minute and the DC-levels difference between right end dithers is larger than the DC-levels difference between right end macroblocks, right end amendment enabling information is made into truth.

[0025]Similarly, when a block noise exists in the left end of the dither-matrix adaptation field containing a noticed picture element, it requires amendment and left end amendment enabling information is not positive and so, it becomes false. A difference with the DC levels of the brightness component of the macroblock which adjoins the DC levels and left-hand side of a brightness component of an applicable macroblock is made into the DC-levels difference between left end macroblocks, A level difference with the average DC levels of the brightness component of the pixel of the right end sequence of the dither-matrix adaptation field contiguous to the average DC levels and left-hand side of a left end sequence of a brightness component is made into the DC-levels difference between left end dithers. [of an applicable dither-matrix adaptation field] [of a pixel] The left end of the target dither-matrix adaptation field is a block border, In a macroblock including the target dither-matrix adaptation field, there is no edge component in inputted image data, When the DC-levels difference between left end macroblocks is minute and the DC-levels difference between left end dithers is larger than the DC-levels difference between left end macroblocks, left end amendment enabling information is made into truth. Let right end DC correction amounts be one half of the values of the DC-levels difference between right end dithers in the target dither-matrix adaptation field. Let left end DC correction amounts be one half of the values of the DC-levels difference between left end dithers in the target dither-matrix adaptation field similarly.

[0026]Next, operation of the pattern selecting means 102 is explained. The pattern selecting means 102 acquires the boundary information of a dither matrix, chooses a dither pattern from pattern change information for every dither-matrix adaptation field, and outputs it as a selection dither pattern. Selection of a dither pattern is performed based on the dither pattern selection matrix shown in drawing 4. The dither pattern to choose is shown in above-mentioned drawing 2.

[0027]If both right end amendment enabling information and left end amendment enabling information are imitations, it will be judged as what a block noise does not have in the target dither-matrix adaptation field, and the dither pattern 1 will be outputted.

[0028]When truth and left end amendment enabling information are imitations, right end amendment enabling information judges that the block noise has occurred at the right end of the target dither-matrix adaptation field, and chooses the dither pattern which can amend this block noise. When a right end DC correction amount is three or more, the dither pattern 3 is chosen, and when a right end DC correction amount is less than -3, the dither pattern 2 is chosen.

[0029]When an imitation and left end amendment enabling information are truth, right end amendment enabling information judges that the block noise has occurred at the left end of the target dither-matrix adaptation field, and chooses the dither pattern which can amend this block noise. When a left end DC correction amount is three or more, the dither pattern 5 is chosen, and when a left end DC correction amount is less than -3, the dither pattern 4 is chosen.

[0030]Although the pattern selection table was used for selection of a pattern in this embodiment, it is satisfactory even if it realizes by the other methods. The adding machine 201 adds a selection dither pattern to inputted image data, and outputs it as output image data.

[0031]Thus, according to this embodiment, in the pattern change information generation means 103, judge the existence of the block noise in a block border, and the information is outputted as noise-patterns information and pattern change information, Based on these two information, the dither pattern which is effective in negating a block noise is chosen and outputted by the

pattern selection information 102. It is ****** to reduce a block noise simultaneously with dithering, without this performing low pass filter processing to inputted image data.

[0032]In the above-mentioned embodiment, the judgment and removal of the block noise in a block border are performed, only by receiving horizontally. However, it is also possible to perform same processing to a perpendicular direction.

[0033](Embodiment 2) Drawing 5 is a block diagram showing the composition of the dither processing unit of the embodiment of the invention 2. This graphic processing equipment has the pattern generating means 105, the bias information generation means 104, and the adding machines 201 and 202. The inputted image data of this equipment is the signal which elongated the compressed image which used discrete cosine transforms, such as MPEG, and output image data is sent out to an external display device etc. The pattern generating means 105 generates the dither pattern added to inputted image data. The bias information generation means 104 creates bias information from inputted image data and block boundary information. The adding machine 202 is the 1st adding machine that adds a dither pattern and bias information and is outputted as a bias correction finishing dither pattern. The adding machine 201 is the 2nd adding machine that adds inputted image data and a bias correction finishing dither pattern, and is outputted as output image data.

[0034]Operation of the dither processing unit constituted as mentioned above is explained below. The pattern generating means 105 generates a dither pattern. In this embodiment, the dither pattern generated in the pattern generating means 105 is the half-tone of 4x4 size, and is the same as the dither pattern 1 of above-mentioned drawing 2. It is not necessary to limit in particular for this dither pattern.

[0035]The boundary of the dither pattern to inputted image data is determined based on block boundary information. Block boundary information shows the boundary position of the macroblock of the inputted image data which elongated the compressed image which used discrete cosine transforms, such as MPEG.

[0036]Reference is not made in particular about the acquisition means of block

boundary information. If it is a case where the inputted image data which has the information the picture display system containing this embodiment shows image data viewing areas, such as data enabling, to be clearly, and elongated the compressed image is not processing scaling etc., It can be judged that there is a block border at intervals of the size of a macroblock from the head of a display.

[0037]If the picture display system containing this embodiment has a decoder etc. which elongate a compressed image inside, it is also possible to acquire block boundary information from this decoder. A block border may be presumed from the feature of inputted image data. Even if it is which case, the macroblock and dither matrix in a display image are arranged so that it may become in physical relationship as shown in above-mentioned drawing 3. In this embodiment, a dither matrix is the size of 4x4, and four dither matrices exist in the area of each macroblock, respectively. Let pixel area which is adapted in one dither pattern to inputted image data be a dither-matrix adaptation field.

[0038]Next, operation of the bias information generation means 104 is explained. The bias information generation means 104 creates bias information from inputted image data and block boundary information. It is investigated whether the noticed picture element used as a processing object is a block border based on block boundary information. When a noticed picture element is a block border, it is investigated whether the block noise exists there further.

[0039]When a noticed picture element is a block border at the right end of a macroblock, a difference with the DC levels of the brightness component which adjoins the DC levels and right-hand side of a brightness component of the macroblock to which a noticed picture element belongs is made into the DC-levels difference between right end macroblocks, A level difference with the DC levels of the brightness component of the pixel which adjoins the DC levels and right-hand side of a brightness component of a noticed picture element is made into the DC-levels difference between right end pixels.

[0040]The target noticed picture element is a block border, and there is no edge component in inputted image data in the macroblock containing the target noticed picture element, When the DC-levels difference between right

end macroblocks is minute and the DC-levels difference between right end pixels is larger than the DC-levels difference between right end macroblocks, it judges that the target noticed picture element needs amendment of DC levels, and the correction amount is outputted as bias information. Let bias information be one half of the values of the DC-levels difference between right end pixels.

[0041]When a noticed picture element is a block border at the left end of a macroblock, a difference with the DC levels of the brightness component which adjoins the DC levels and left-hand side of a brightness component of the macroblock to which a noticed picture element belongs similarly is made into the DC-levels difference between left end macroblocks, A level difference with the DC levels of the brightness component of the pixel which adjoins the DC levels and left-hand side of a brightness component of a noticed picture element is made into the DC-levels difference between left end pixels.

[0042]The target noticed picture element is a block border, and there is no edge component in inputted image data in the macroblock containing the target noticed picture element, When the DC-levels difference between left end macroblocks is minute and the DC-levels difference between left end pixels is larger than the DC-levels difference between left end macroblocks, it judges that the target noticed picture element needs amendment of DC levels, and the correction amount is outputted as bias information. Let bias information be one half of the values of the DC-levels difference between left end pixels.

[0043]The adding machine 202 adds bias information to the dither pattern generated from the above-mentioned pattern generating means 105, and outputs it to it as a dither pattern with bias. The adding machine 201 adds a dither pattern with bias to inputted image data, and outputs it as output image data. However, when inputted image data is RGB data, in the adding machine 202, Y-RGB conversion is performed to bias information, and the bias information for every RGB is searched for. The bias information and dither pattern for every RGB are added, and the dither pattern with bias for every RGB is outputted. In the adding machine 201, the dither pattern with bias for every RGB is added to inputted image data.

[0044]Thus, according to this embodiment, the information which judges the

existence of the block noise in a block border in the bias information generation means 104, and amends it is outputted as bias information, A dither pattern and bias information are added in the adding machine 202, and it outputs as a dither pattern with bias. The bias on which this dither pattern with bias amends the block noise of inputted image data is added. It is ****** to reduce a block noise simultaneously with dithering, without this performing low pass filter processing to inputted image data.

[0045]In the above-mentioned embodiment, the judgment and removal of the block noise in a block border are performed, only by receiving horizontally. However, it is also possible to perform same processing to a perpendicular direction.

[0046](Embodiment 3) Drawing 6 is a block diagram showing the composition of the dither processing unit of the embodiment of the invention 3. This graphic processing equipment has the pattern generating means 105, the bias information generation means 104, the low pass filter 106, and the adding machines 201 and 202. This equipment adds the low pass filter 106 to the dither processing unit of Embodiment 2. Since other composition is the same as that of Embodiment 2, explanation is omitted.

[0047]The low pass filter 106 performs low pass filter processing to the bias information outputted from the bias information generation means 104, and outputs the result as filtering finishing bias information. The adding machine 202 adds filtering finishing bias information to the dither pattern generated from the pattern generating hand 105, and outputs it to it as a dither pattern with bias. The adding machine 201 adds a dither pattern with bias to inputted image data, and outputs it as output image data.

[0048]Thus, according to this embodiment, the low pass filter 106 can ease the abrupt change of bias information, and can ease the rapid video change of the output image data outputted through the adding machine 202 and the adding machine 201.

[0049]In the above-mentioned embodiment, the judgment and removal of the block noise in a block border are performed, only by receiving horizontally. However, it is also possible to perform same processing to a perpendicular direction.

[0050](Embodiment 4) Drawing 7 is a block diagram showing the composition

of the dither processing unit of the embodiment of the invention 4. This graphic processing equipment has the pattern generating means 105, bias information and the adjacent pixel information generation means 107, the low pass filter 108 with condition determination, and the adding machines 201 and 202. This equipment transposes the bias information generation means 104 of the dither processing unit of Embodiment 3 to bias information and the adjacent pixel information generation means 107, and transposes the low pass filter 106 to the low pass filter 108 with condition determination. In addition, since composition is the same as that of Embodiment 2, explanation is omitted.

[0051]Bias information and the adjacent pixel information generation means 107 create bias information and adjacent pixel information from inputted image data and block boundary information. Since the preparation method of bias information is the same as that of Embodiment 2 and Embodiment 3, explanation is omitted and the preparation method of adjacent pixel information is explained below. There are two, right-hand side relaxation enabling information and left-hand side relaxation enabling information, in adjacent pixel information. When a noticed picture element is a block border at the right end of a macroblock, bias information is created based on the method shown by Embodiment 2. That is, when a noticed picture element is a generation place of a block noise, let bias information be one half of the values of the DC-levels difference between right end pixels.

[0052]The difference of the luminosity DC levels of the pixel which furthermore adjoins a noticed picture element and its left-hand side is made into a left contiguity luminance level difference, and the difference of the luminosity DC levels of the pixel which adjoins the left-hand side of what added bias information to the luminosity DC levels of the noticed picture element, and a noticed picture element is made into the contiguity luminance level difference after left amendment. When the contiguity luminance level difference after left amendment is larger than a left contiguity luminance level difference, left-hand side relaxation enabling information is made positive.

[0053]When a noticed picture element is a block border at the left end of a macroblock, bias information is created based on the method shown by Embodiment 2. That is, when a noticed picture element is a generation place of a block noise, let bias information be one half of the values of the DC-levels

difference between left end pixels.

[0054]The difference of the luminosity DC levels of the pixel which furthermore adjoins a noticed picture element and its right-hand side is made into a right contiguity luminance level difference, and the difference of the luminosity DC levels of the pixel which adjoins the left-hand side of what added bias information to the luminosity DC levels of the noticed picture element, and a noticed picture element is made into the contiguity luminance level difference after right amendment. When the contiguity luminance level difference after right amendment is larger than a right contiguity luminance level difference, right-hand side relaxation enabling information is made positive.

[0055]The low pass filter 108 with condition determination performs low pass filter processing to the bias information outputted from bias information and the adjacent pixel information generation means 107 according to adjacent pixel information, and outputs the result as filtering finishing bias information. There are two, right-hand side relaxation enabling information and left-hand side relaxation enabling information, in adjacent pixel information as above-mentioned. If right-hand side relaxation enabling information is positive, low pass filter processing will be performed to the bias information corresponding to a noticed picture element and the pixel near the right-hand side neighborhood, and it will output as filtering finishing bias information. If left-hand side relaxation enabling information is positive, low pass filter processing will be performed to the bias information corresponding to a noticed picture element and the pixel near the left-hand side neighborhood, and it will output as filtering finishing bias information.

[0056]The adding machine 202 adds filtering finishing bias information to the dither pattern generated from the pattern generating hand 105, and outputs it to it as a dither pattern with bias. The adding machine 201 adds a dither pattern with bias to inputted image data, and outputs it as output image data.

[0057]Thus, according to this embodiment, the low pass filter 108 with condition determination can ease this selectively, only when bias information changes rapidly, and it can ease the rapid video change of the output image data outputted through the adding machine 202 and the adding machine 201.

[0058]In the above-mentioned embodiment, the judgment and removal of the block noise in a block border are performed, only by receiving horizontally.

However, it is also possible to perform same processing to a perpendicular direction.

[0059](Embodiment 5) Drawing 8 is a block diagram showing the composition of the dither processing unit of the embodiment of the invention 5. This graphic processing equipment has the pattern generating means 101, the minimum error pattern selecting means 109, and the adding machine 201. The inputted image data of this equipment is the signal which elongated the compressed image which used discrete cosine transforms, such as MPEG, and output image data is sent out to an external display device etc. The pattern generating means 101 generates two or more two or more dither patterns. The minimum error pattern selecting means 109 chooses one pattern from two or more patterns by which it was generated in the pattern generating means 101 based on inputted image data, and outputs it as a selection dither pattern. The adding machine 201 adds a selection dither pattern to inputted image data, and outputs it as output image data.

[0060]Operation of the dither processing unit constituted as mentioned above is explained below. The pattern generating means 101 generates two or more two or more dither patterns. An internal pattern is set to three in this embodiment. However, this number in particular is not limited, and even if there are more patterns than this, there is no problem in particular at least. About a pattern, the pattern which also used patterns generally used well, such as half-tone, a screw, and Mayer, by the above-mentioned Embodiment 1 is also realizable. It does not limit in particular for the pattern to be used.

[0061]Next, the minimum error pattern selecting means 109 is explained. The pattern selection method in the minimum error pattern selecting means in the embodiment of the invention 5 is shown in drawing 9. Let pixel area which is adapted in one dither pattern be a dither-matrix adaptation field to the inputted image data used as a processing object. The minimum error pattern selecting means 109 calculates the luminance value of each pixel contained to a dither-matrix adaptation field.

[0062]Each of two or more patterns by which it was furthermore generated in the pattern generating means 101, and the image data of this dither-matrix adaptation field are added. Since three 4x4-pixel dither matrices are prepared in this embodiment, 3 sets of added results are created. Let this added result

be a dither-matrix adaptation field added result. As for each dither-matrix adaptation field added result, 16-pixel data is contained. About each of all the pixels of the inputted image data in a dither-matrix adaptation field, and each of all the pixels contained in a dither-matrix adaptation field added result, the pixels of the same position of a matrix are subtracted, respectively and a square sum is taken.

That is, they are D (0, 0)-D (3, 3) about input data.

It is the dither pattern 1 P1 (0, 0)-P1 (3, 3)

It is the dither pattern 2 P2 (0, 0)-P1 (3, 3)

It is the dither pattern 3 P3 (0, 0)-P1 (3, 3)

When it carries out, it is sigma $\{D(i, j) (-P1 (i, j))^2\}$.

sigma $\{D(i, j) (-P2 (i, j))^2\}$

sigma $\{D(i, j) (-P3 (i, j))^2\}$

********.

[0063]It ranks next to all the dither patterns, this processing is performed, and a square sum asks for the dither pattern which becomes the smallest. It outputs as the dither pattern to which a square sum adds the dither pattern which becomes the smallest to the inputted image data in the dither-matrix adaptation field used as a processing object, i.e., a selection dither pattern. The adding machine 201 adds a selection dither pattern to inputted image data, and outputs it as output image data.

[0064]Thus, according to this embodiment, the dither pattern which does not emphasize a noise to inputted image data with many noise components can be added selectively.

[0065]In the above-mentioned embodiment, the judgment and removal of the block noise in a block border are performed, only by receiving horizontally. However, it is also possible to perform same processing to a perpendicular direction.

[0066]

[Effect of the Invention]According to the dither processing unit of this invention, the dither processing unit which has a function which reduces the block noise produced when elongating the video signal compressed by the discrete cosine transform can be provided as mentioned above.

[Translation done.]

* NOTICES *

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2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

CLAIMS

[Claim(s)]
[Claim 1]A pattern generating means which generates a dither pattern characterized by comprising the following used as a standard, and two or more dither patterns created by a thing which constitute said dither pattern, and for which specific offset is added or subtracted to all the pixels of each in part, A boundary of a dither matrix arranged so that a boundary of a dither pattern added to inputted image data decoded by discrete cosine transform used as a boundary of a macroblock of a discrete cosine transform which block boundary information shows, and a processing object may be in agreement.
A pattern change information generation means which outputs a pattern of a block noise as noise-patterns information when having generated with whether a block noise has occurred in a dither pattern containing said inputted image data which outputs pattern change information and serves as a processing object.
A pattern selecting means which chooses optimal pattern from said two or more dither patterns generated in said pattern generating means according to said noise-patterns information in an image display position which said pattern change information shows, and is outputted as a selection dither pattern, An adding machine which is added with said selection dither pattern and said inputted image data, and is outputted as output image data.

[Claim 2]A dither processing unit comprising:
A pattern generating means which generates a dither pattern so that a boundary of a dither pattern added to inputted image data decoded by discrete cosine transform used as a boundary of a macroblock of a discrete cosine transform which block boundary information shows, and a processing object may be in agreement.
A bias information generation means which outputs bias which amends a block noise when a block noise has occurred in a dither matrix which contains inputted image data used as a processing object from said inputted image data and said block boundary information as bias information.
The 1st adding machine that adds said bias information and said dither pattern, and is outputted as a dither pattern with bias.
The 2nd adding machine that adds said dither pattern with bias, and said inputted image data, and is outputted as output image data.

[Claim 3]The dither processing unit according to claim 2 adding a low pass filter which performs low pass filter processing to bias information outputted from said bias information generation means, and is outputted as filtering finishing bias information.
[Claim 4]A dither processing unit comprising:
A pattern generating means which generates a dither pattern so that a boundary of a dither pattern added to inputted image data decoded by discrete cosine transform used as a boundary of a macroblock of a discrete cosine transform which block boundary information shows, and a processing object may be in agreement.
Bias which amends a block noise when a block noise has occurred in a dither matrix containing inputted image data decoded by discrete cosine transform and inputted image data which serves as a processing object based on block boundary information is outputted as bias information, When luminance difference with an adjacent pixel which adjoins a value adding a luminance value of a noticed picture element and corresponding bias information and a noticed picture element is larger than luminance difference with an adjacent pixel which adjoins a noticed picture element which a block noise has generated in inputted image data, and a noticed picture element, Bias

information and an adjacent pixel information generation means which output adjacent pixel information which shows that low pass filter processing to bias information corresponding near the noticed picture element is enabled.
Low pass filter processing is carried out to bias information to which adjacent pixel information is outputted from said bias information generation means only to a part of enabling, A low pass filter with condition determination outputted to a part which is not enabling as filtering finishing bias information without carrying out low pass filter processing to bias information.
The 1st adding machine that adds said bias information and said dither pattern, and is outputted as a dither pattern with bias, and the 2nd adding machine that adds said dither pattern with bias, and said inputted image data, and is outputted as output image data.

[Claim 5]Data of each pixel of a result of having added said several different dither patterns to inputted image data of a picture element range which adds a pattern generating means which generates several different dither patterns, and one pattern used as a processing object, respectively, Inputted image data of a picture element range which adds one pattern used as said processing object is compared based on an internal algorithm, A minimum error pattern selecting means which chooses one dither pattern from said two or more dither patterns, and is outputted as a selection dither pattern, A dither processing unit provided with an adding machine which is added with said selection dither pattern and said inputted image data, and is outputted as output image data.

[Translation done.]

* NOTICES *

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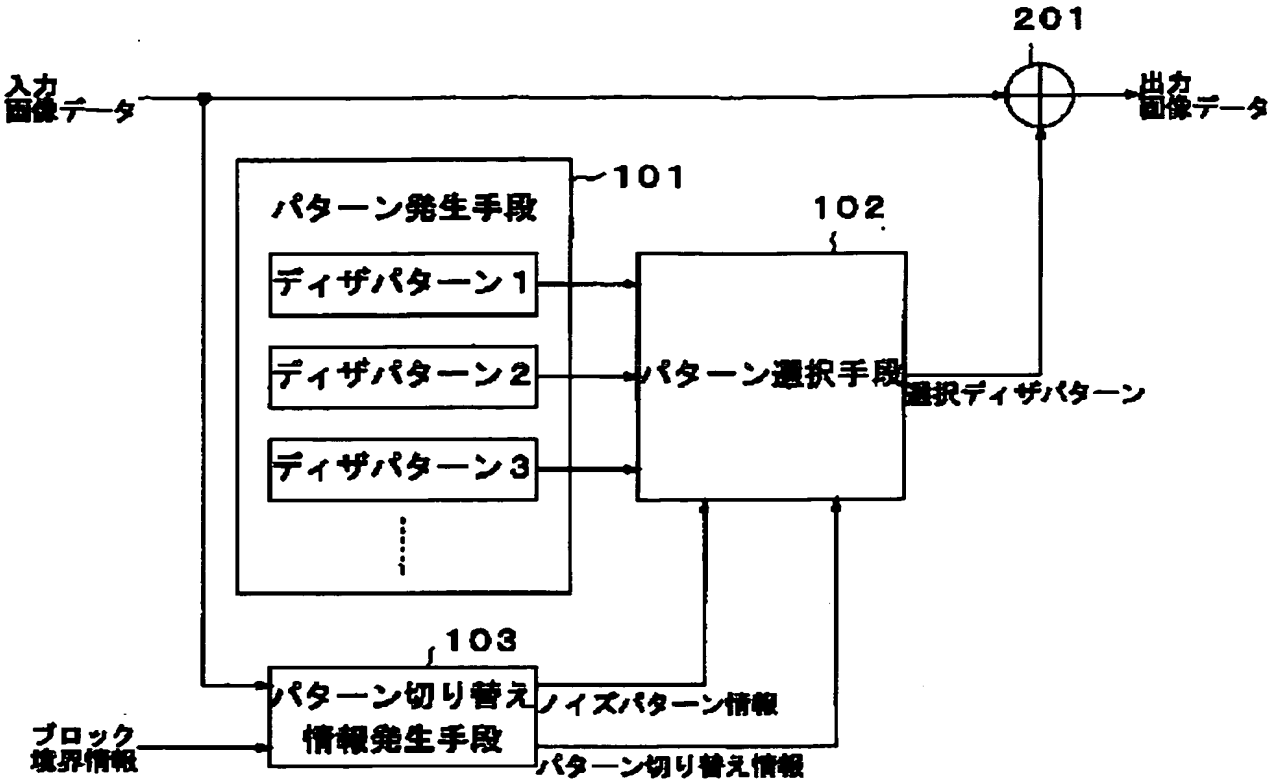
DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1]It is a block diagram of the dither processing unit by the embodiment of the invention 1.
[Drawing 2]It is a pattern by which it is generated in the pattern generating means in the embodiment of the invention 1.
[Drawing 3]an embodiment of the invention -- it is the physical relationship of the macroblock which can be set, and a dither matrix one.
[Drawing 4]an embodiment of the invention -- it is a dither pattern selection matrix which can be set one.
[Drawing 5]It is a block diagram of the dither processing unit by the embodiment of the invention 2.
[Drawing 6]It is a block diagram of the dither processing unit by the embodiment of the invention 3.
[Drawing 7]It is a block diagram of the dither processing unit by the embodiment of the invention 4.
[Drawing 8]It is a block diagram of the dither processing unit by the embodiment of the invention 5.
[Drawing 9]It is a pattern selection method in the minimum error pattern selecting means in the embodiment of the invention 5.
[Explanations of letters or numerals]
101 Pattern generating means
102 Pattern selecting means

103 Pattern change information generation means
104 Bias information generation means
105 Pattern generating means
106 Low pass filter
107 Bias information and an adjacent pixel information generation means
108 A low pass filter with condition determination
109 Minimum error pattern selecting means
201 Adding machine
202 Adding machine

[Translation done.]


201
入力
画像データ
出力
画像データ
パターン発生手段
101
ディザパターン1
ディザパターン2
ディザパターン3
102
パターン選択手段
選択ディザパターン
103
パターン切り替え
情報発生手段
ノイズパターン情報
パターン切り替え情報
ブロック
境界情報

パターン1

0	8	2	10
12	4	14	6
3	11	1	9
15	7	13	5

パターン2

0	9	4	13
12	5	16	9
3	12	3	12
16	8	15	8

パターン3

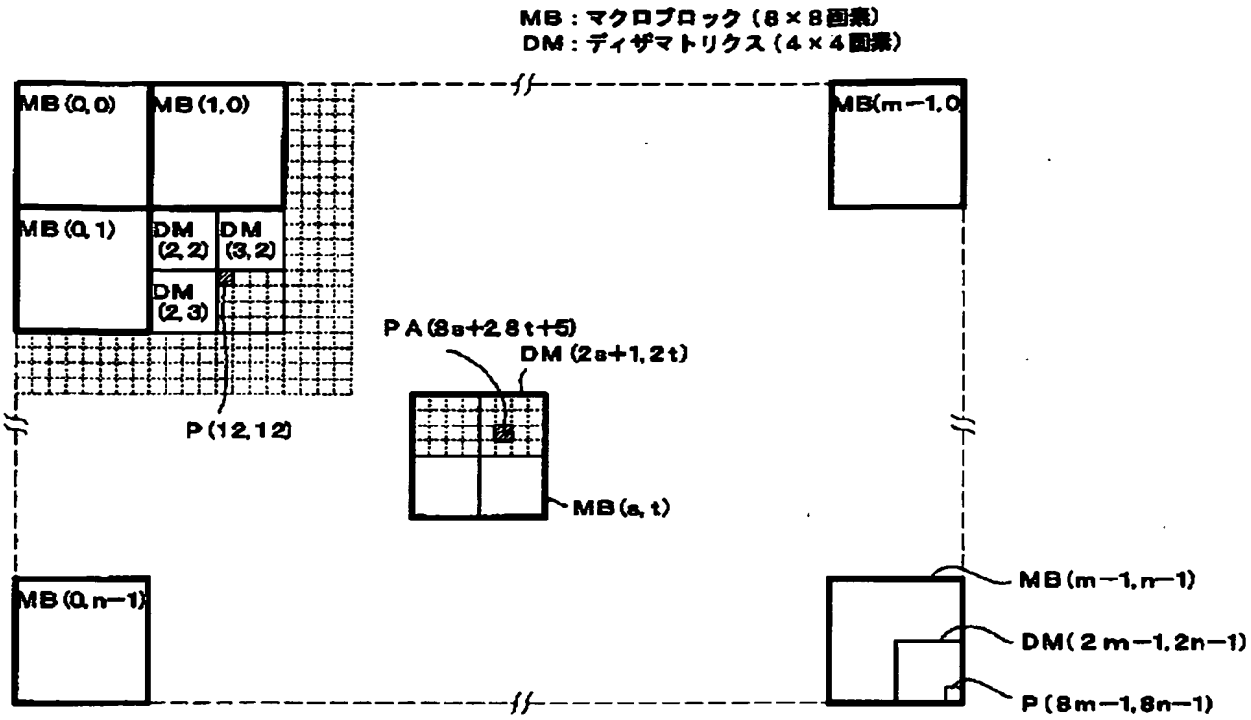
0	7	0	7
12	3	12	3
3	10	−1	6
15	6	11	2

パターン4

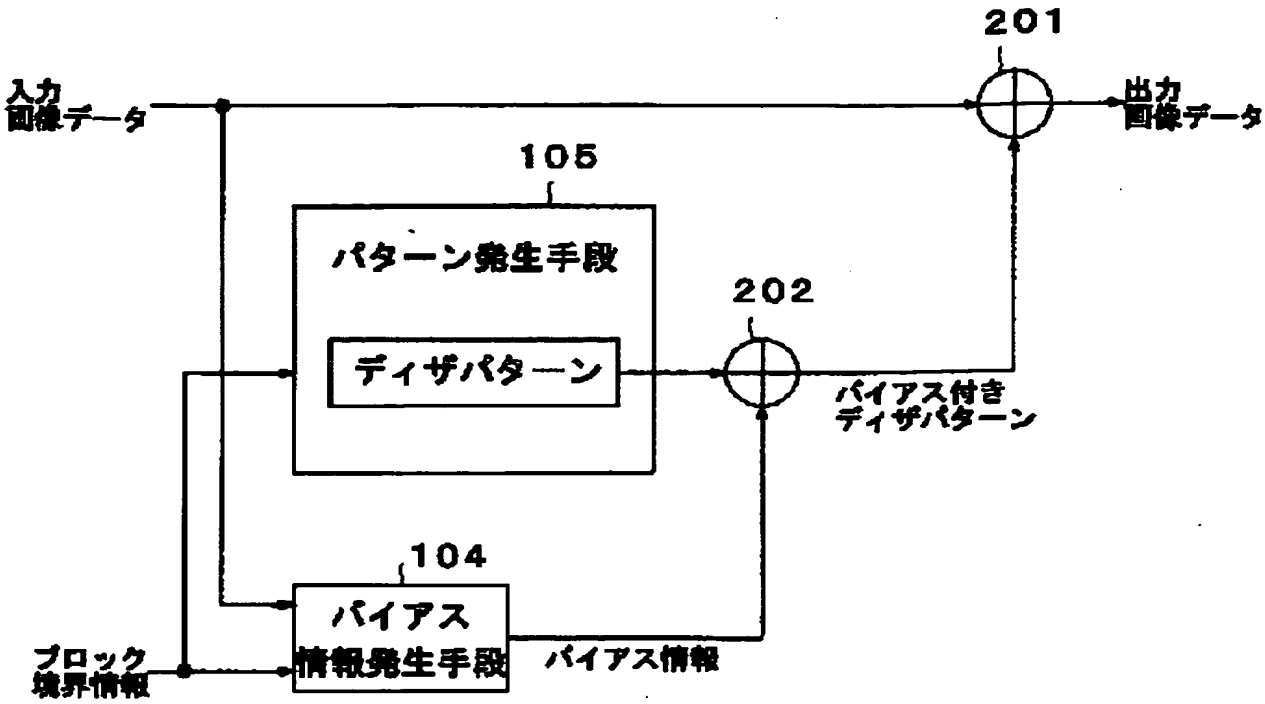
3	10	3	10
15	6	15	6
6	13	2	9
18	9	14	6

パターン5

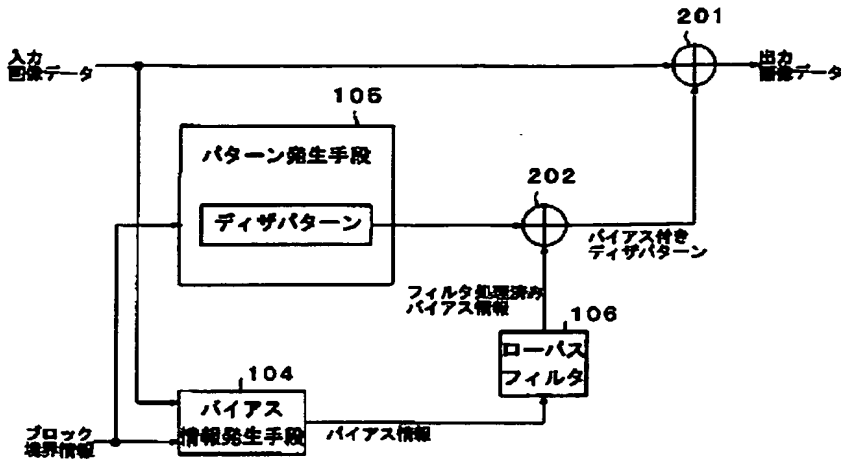
−3	6	1	10
9	2	13	6
0	9	0	9
12	5	12	5


MB：マクロブロック（8×8画素）
DM：ディザマトリクス（4×4画素）
MB (0,0)
MB (1,0)
MB(m−1,0)
MB (0,1)
DM (2,2)
DM (3,2)
DM (2,3)
PA(8s+2,8t+5)
DM (2s+1,2t)
P(12,12)
MB (s,t)
MB (0,n−1)
MB (m−1,n−1)
DM(2m−1,2n−1)
P(8m−1,8n−1)

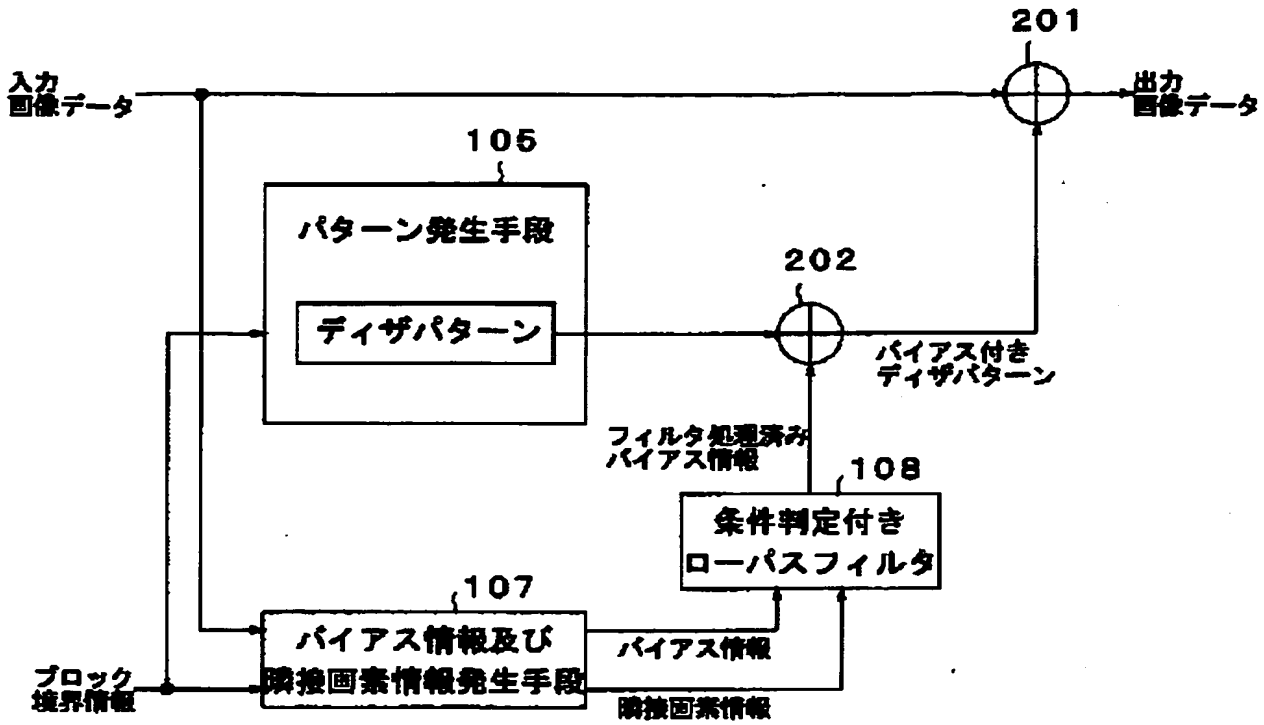
ノイズパターン情報			選択ディザパターン
右端補正イネーブル：偽 左端補正イネーブル：偽			ディザパターン１
右端補正イネーブル：真 左端補正イネーブル：偽	右端ＤＣ補正量	３以上	ディザパターン３
		－２以上　２以下	ディザパターン１
		－３以下	ディザパターン２
右端補正イネーブル：偽 左端補正イネーブル：真	左端ＤＣ補正量	３以上	ディザパターン５
		－２以上　２以下	ディザパターン１
		－３以下	ディザパターン４

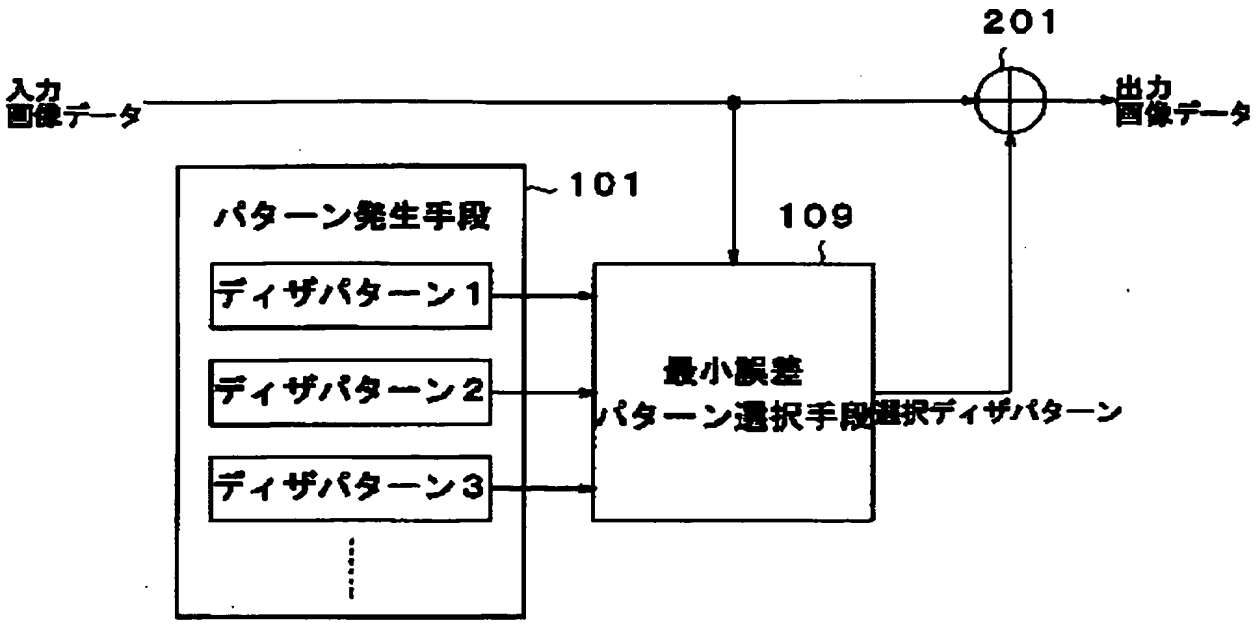

201
入力
画像データ
出力
画像データ
105
パターン発生手段
ディザパターン
202
バイアス付き
ディザパターン
104
バイアス
情報発生手段
バイアス情報
ブロック
境界情報

Drawing selection Drawing 6



[Translation done.]


201
入力
画像データ
出力
画像データ
105
パターン発生手段
ディザパターン
202
バイアス付き
ディザパターン
フィルタ処理済み
バイアス情報
108
条件判定付き
ローパスフィルタ
107
バイアス情報及び
隣接画素情報発生手段
バイアス情報
ブロック
境界情報
隣接画素情報


201
入力
画像データ
出力
画像データ
101
パターン発生手段
ディザパターン1
ディザパターン2
ディザパターン3
109
最小誤差
パターン選択手段
選択ディザパターン

入力画像データ画素

D(0,0)	------	------	D(3,0)
------	------	------	------
------	------	------	------
D(0,3)	------	------	D(3,3)

パターン1

P1(0,0)	------	------	P1(3,0)
------	------	------	------
------	------	------	------
P1(0,3)	------	------	P1(3,3)

パターン2

P2(0,0)	------	------	P2(3,0)
------	------	------	------
------	------	------	------
P2(0,3)	------	------	P2(3,3)

パターン3

P3(0,0)	------	------	P3(3,0)
------	------	------	------
------	------	------	------
P3(0,3)	------	------	P3(3,3)